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THROMBOLYTIC THERAPY, REPERFUSION PHENOMENA, AND MYOCARDIAL RECOVERY: INFLUENCE OF GENDER

by

Colleen R. Grinter

A Thesis Presented in Partial Fulfillment
of the Requirements for the Degree
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THROMBOLYTIC THERAPY, REPERFUSION PHENOMENA,

AND MYOCARDIAL RECOVERY: INFLUENCE OF GENDER

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ABSTRACT

Gender differences have been noted in mortality rates after thrombolytic therapy demonstrating that women do not fare as well as men. Several hypotheses exist to explain these differences. The hypothesis of interest in this study is whether the recovery from myocardial infarction after thrombolytic therapy might be different in men than in women. Angiographic studies have indicated the initial signs of reperfusion and beginning of myocardial recovery are observed clinically as reperfusion phenomena. The five categories of reperfusion phenomena are chest pain relief, dysrhythmias, hemodynamic changes, rapid evolution of the electrocardiogram, and creatinine kinase release. This study examined the difference of reperfusion phenomena occurrence between men and women. A retrospective chart review of 29 women and 38 men was completed from three community hospitals. No significant difference ($p < .05$) between men and women was found in the time from thrombolytic initiation to chest pain relief or to ST-segment resolution. A subset of 23 subjects, found that men had significantly more ventricular tachycardia (VT) ($p = .013$) and lower blood pressures at the time of reperfusion than women. Women, however, had significantly ($p = .043$) less incidence of reperfusion. This may explain why women have less reduction in mortality rates after

thrombolytic therapy than men. Women were also on significantly (p = .012) more cardiac medications than men. The time from the onset of symptoms to the initiation of thrombolytic treatment averaged 24 minutes longer in women than men, although this difference was not statistically significant (p > .05). There were no significant differences in men and women in the occurrence of the infarct-related artery, percentage of occlusion, or percentage of LVEF. Women, however, were less often referred for cardiac catheterization, angioplasty and coronary artery bypass surgery. The critical care nurse can use the findings of this study to anticipate potential problems at the time of reperfusion following thrombolytic therapy as they occur in men and women and to better understand the possible causes of higher mortality rates in women than in men after acute myocardial infarction.

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CHAPTER 1

Introduction

Acute myocardial infarction (AMI) remains a major cause of death and disability in the United States today for both men and women (American Heart Association, 1992). It is believed that the most common cause of AMI is secondary to thrombus formation occluding the coronary arteries and causing death to the myocardial tissue from the lack of blood flow. To reduce mortality from AMI, interventions are directed at reperfusing or reestablishing blood flow to the ischemic myocardium. This is termed reperfusion and is defined as restoration of blood flow to the ischemic myocardial cells (Coombs, Black, & Townsend, 1992).

The most common method of reperfusion in the setting of AMI is the intravenous use of a thrombolytic agent (Coombs et al., 1992). By lysing the occlusive coronary clot thrombolytic agents actually interrupt the evolution of AMI. The goals of thrombolysis are to reestablish coronary artery patency, decrease the size of the infarct, improve ventricular function, and decrease morbidity and mortality (Braunwald, 1987).

The use of thrombolytic agents, while promising to be a potential life-saving maneuver, is not without risks and must be used cautiously. Because monitoring equipment and trained personnel are necessary to assess and intervene in

the event complications arise, critical care nurses are usually responsible for the administration and monitoring of this treatment (Lepley-Frey, 1991).

One of the most common complications of thrombolysis is the new onset of dysrhythmias believed to be secondary to the process of reperfusion (Lepley-Frey, 1991). In fact, these dysrhythmias are considered to be part of the "reperfusion phenomena" often used to predict reperfusion at the bedside. Several angiographic studies (Kirchner & Topol, 1987; Lewis, Lew, & Ganz, 1988; Zabel, Hohnloser, Kasper, Meinertz, & Just, 1991) together described five major categories of reperfusion phenomena: pain relief; dysrhythmias; physiological changes; evolution of the electrocardiogram (EKG), and creatinine kinase (CK) release. These reports agreed the more reperfusion phenomena that occur simultaneously in an individual patient, the higher the chance that the reperfusion has occurred.

The literature has not revealed any studies comparing men and women in the occurrence of reperfusion phenomena. However, gender differences have been noted in mortality rates demonstrating that in general women do not do as well (Anglo-Scandinavian Study of Early Thrombolysis, 1988; ISIS-2, 1988; Kennedy et al., 1988). Several hypotheses exist to attempt to explain this difference. The hypothesis of interest in this study is that women

have reduced myocardial salvage resulting in less effective preservation of myocardial function or that women have more frequent cardiac events after thrombolysis. These hypotheses raise the intriguing question of whether the pathogenesis of infarction or the recovery from infarction might be different in men and women (Eysmann & Douglas, 1992). The initial signs of myocardial recovery occurs clinically as reperfusion phenomena. If these phenomena occur differently in men and women it would be supportive that myocardial recovery also occurs differently in men than women.

The purpose of this study was to examine the occurrence of four of the five major categories of reperfusion phenomena and how they occur in the different genders. This study was aimed at answering the following questions:

1. Does the relief of chest pain at the time of perceived reperfusion occur differently in men than women?

2. Do reperfusion dysrhythmias occur differently in women than men?

3. Do blood pressure changes associated with the reperfusion dysrhythmias occur differently in women than men?

4. Does the ST-segment resolution after reperfusion occur differently in men than women?

Care of the patient undergoing treatment with thrombolytic therapy requires close observation by the

nurse. The nurse is typically at the bedside and is the most likely one to be there at the time of reperfusion; therefore, it is important that she or he understand and recognize reperfusion phenomena. This study assists the nurse in the recognition and understanding of reperfusion phenomena and its occurrence in the different genders. It may also assist in determining whether there is a difference between genders in the initial recovery of the myocardium at the time of reperfusion.

CHAPTER 2

Review of Literature and Theoretical Framework

Thrombolytic therapy is used in treating AMI in an attempt to dissolve the fibrin clot in the obstructed coronary artery. When successful, several physiological events may occur leading to clinically observable reperfusion phenomena. The literature review of reperfusion phenomena in thrombolytic therapy and the theoretical and conceptual framework used for this study are discussed in this section.

Lewis et al. (1988) listed five reperfusion phenomena that are considered clinical markers of myocardial reperfusion. These phenomena are relief of chest pain, changes in cardiac rhythm and conduction and frequent hemodynamic changes seen as a part of these dysrhythmias, resolution of ST-segment changes, and serum CK and CKMB activities. Of these five phenomena, four can be detected at the patient's bedside without invasive techniques. As stated in the introduction the more of these observable phenomena occur simultaneously the more reliable they are for detecting reperfusion. Since angiography is not typically available to recognize reperfusion during intravenous thrombolytic therapy it is important to recognize these phenomena clinically.

First, Topol et al. (1988) found that chest pain relief was a very strong predictor of reperfusion. Lewis

et al. (1988) also stated that a lessening of chest pain begins within minutes of the demonstration of reperfusion and almost simultaneously with the occurrence of other nonangiographic manifestations. Following reperfusion this chest pain resolves rapidly over 15 to 20 minutes and is said by Lewis et al. to be readily recog[illegible]ed even by patients who have received morphine.

The second reperfusion phenomenon is that of dysrythmias. Lepley-Frey's (1991) study concentrated on reperfusion dysryhthmias and their hemodynamic effect. The theoretical framework used in this study differentiated reperfusion arrhythmias as caused by nonreentrant mechanisms verses ischemic dysrhythmias that are usually caused by reentrant mechanisms. This idea was based on the assumption that there is heterogeneous recovery of electrical activity in the myocardial cells following reperfusion. This recovery is a chaotic attempt of the cells to return their electrical properties to normal thus being vulnerable to dysrhythmic behavior.

Lepley-Frey (1991) described several mechanisms thought to contribute to heterogeneity of electrical activity following reperfusion which include: (a) dysrhythmogenic metabolite accumulation; (b) increased dispersion of refractoriness of cells; (c) catecholamine release and an increase in the number and responsiveness of alpha-adrenergic receptors.

Interestingly, through retrospective chart review, Lepley-Frey (1991) reported the most frequent arrhythmia to be sinus bradycardia (SB), followed by idioventricular and accelerated idioventricular rhythms (IVR/AIVR), premature ventricular contractions (PVCs), ventricular tachycardia (VT), and ventricular fibrillation (VF). These findings are in contrast to other angiographic findings (Gressin, Louvard, Pazzano, & Lardoux, 1991; Lewis et al., 1988) of AIVR and ventricular extrasystoles being found in 60-80% of the patients experiencing reperfusion. Lepley-Frey believed that one possibility for explaining the SB frequency was that some of them may have truly been ischemic rhythms rather than reperfusion in origin. It would be interesting to know the location of infarct in these patients because SB is frequently seen in reperfusion of inferior and posterior infarctions (Irwin, 1988).

Another aspect of the Lepley-Frey study (1991) was the assessment of the drop in blood pressure that is also considered a reperfusion phenomenon. Lepley-Frey was interested in whether the hemodynamic parameters occurred in association with the reperfusion arrhythmias verses some innate characteristic of TPA. No drop in blood pressure was associated with TPA but the data did suggest hemodynamic impairment associated with the reperfusion

arrhythmias, ventricular dysrhythmias being the most severe.

The fourth reperfusion phenomenon is the changes seen in the ST-segment evolution. With today's high-tech monitoring devices even ST-segment evolution can be seen on the bedside monitors, although this is not the most reliable method. Therefore, the usual policy for observation of the above phenomena is to obtain a 12-lead EKG. Improvement of the ST-segment elevation begins within minutes of both angiograghic and nonangiograghic manifestations of reperfusion. This decrease is a rapid falling by 50% or more of their elevated levels during a period of 10 to 20 minutes (Lewis et al., 1988). Other observations reported the ST-segment returning to or near to the normal isoelectric baseline within 180 minutes (Krucoff, Green, & Satler, 1986). Otherwise the evolution of ST-segment lasts several hours to days when reperfusion does not occur (Lewis et al., 1988).

During myocardial cell injury, the cell membrane ruptures and CK is released into the serum. The specific isoenzyme associated with the heart is CKMB. In the normal evolution of AMI these enzymes elevate as early as 3-6 hours and peak in approximately 24 hours (Fiolet et al., 1983; Moseley, 1992). Reperfusion, however, results in an abrupt rise in serum CK and CKMB activity caused by the rapid washout from the area of the irreversibly

damaged cells. Lewis et al. (1988) documented CK and CKMB activities after reperfusion confirmed by angiography finding a rapid rise taking place within the first few minutes and through out the first hour peaking between 6 and 12 hours. These results can be found through simple laboratory analysis and though they are not normally the earliest manifestation of reperfusion phenomena to be noticed in the clinical setting they can be helpful in confirmation of reperfusion.

In reviewing the literature no information was found comparing the occurrence of reperfusion phenomenon in the different genders. Early studies have suggested no significant differences in the pharmacokinetics of tissue-type plasminogen activator or coronary artery patency rates in men compared to women in the setting of AMI (Becker, 1990). Most important, intravenous thrombolytic therapy in AMI reduces mortality rates in both sexes (Eysmann & Douglas, 1992). Eysmann and Douglas reviewed the thrombolysis trials (Anglo-Scandinavian Study of Early Thrombolysis, 1988; European Working Party, 1971; Gruppo Italiano (GISSI), 1986, 1987; ISIS-2, 1988; Kennedy et. al., 1988) which have reported mortality data by gender and found three patterns to be evident. First, intravenous thrombolysis clearly reduced mortality rates in the setting of AMI in both men and women. Second, the mortality rates after AMI were higher among women than

among men in both the placebo and the thrombolysis groups. Third, GISSI excluded, these randomized trials have shown a relatively lower reduction in mortality rates in women than in men (Eysmann & Douglas, 1992).

Several hypotheses were described by Eysmann and Douglas (1992) to explain these differences. One is that women are typically older when they present with an AMI and thus have more prevailing disease. Legato and Colman (1991) suggest that the diagnosis and treatment of women at a later age and stage of disease may also be the result of gender bias in the diagnosis and management of coronary artery disease (CAD) and that in many cases, women or their doctors, or both, have ignored or neglected important warning signs of CAD.

Another hypothesis is that women have a greater number of complications with thrombolysis than men in part because they are older (Eysmann & Douglas, 1992). It is also been postulated that to decrease complications, there needs to be dosage modification of thrombolytic therapy for women according to their smaller size and older age (Bovill et al., 1991). This has yet to be addressed in thrombolytic trials.

There is also thought that gender bias may play a role in the selection of patients for thrombolysis, with a less aggressive selection for women. One study found the selection bias to be more related to greater age and

prevalence of disease (Pfeffer et al., 1991). However, another study found that only 55% of eligible women compared to 78% of eligible men were selected for thrombolytic therapy (Maynard, Althouse, Cerqueira, Olsufka, & Kennedy, 1991). In this study, the mean age for women and men was the same.

Two other hypotheses are that women have reduced myocardial salvage, resulting in less effective preservation of myocardial function, or that women have more frequent cardiac events after thrombolysis. Eysmann and Douglas (1992) pointed out that these last two hypotheses raise the question of whether the pathogenesis of infarction or recovery from infarction might be different in men and women. This study was most interested in any difference between men and women in the initial phase of recovery of which the first detectable clinical signs are reperfusion phenomena.

The conceptual framework for this study indicates that both males and females can experience the symptoms of ischemia or AMI, and thus, they will seek help. When they reach the hospital diagnostic studies will be done as well as assessment of patient history. The physician can then use all this information together to make a diagnosis of AMI as appropriate. If the patient is within 4-6 hours from the first onset of symptoms then evaluation for thrombolytic therapy will be done. If the patient is a

candidate for thrombolytic therapy it will be started according to protocol. The patient is closely monitored for complications such as bleeding, stroke, and for signs of reperfusion. The patient may receive pain medications, antiarrhythmics, nitroglycerin, beta-blockers, and other cardiac medications during this time frame in the attempt to treat the ischemic process. Once reperfusion has occurred any or all of the reperfusion phenomena may be seen (Figure 1).

Reliable and early recognition of reperfusion from thrombolytic therapy is important. The hemodynamic consequences of the reperfusion dysryhthmias alone can compromise the patient. Often the critical care nurse is given standing orders to treat these, but notifying the doctor is imperative since the occurrence of reperfusion may modify the duration of thrombolytic therapy, the use of other modalities of acute revascularization and of anticoagulation to prevent reocclusion of the infarcted artery.

If reperfusion phenomena occur differently in men than in women then this may be supportive evidence that recovery of the myocardium after thrombolytic therapy is also different. This may explain in part why women do not fare as well as men after thrombolytic therapy. Any differences found in the recovery of the myocardium may eventually affect our methods of treatment.

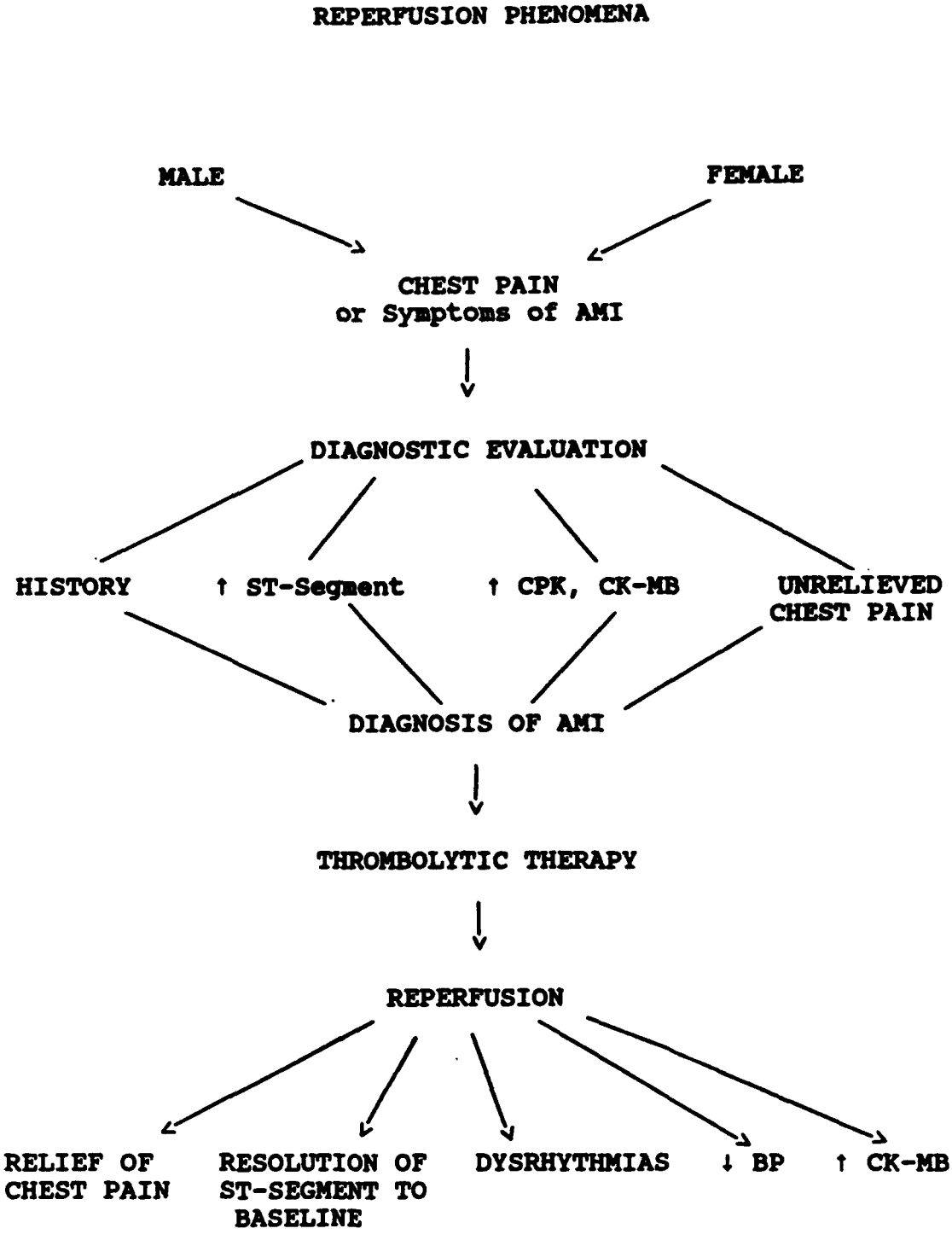

Figure 1. Model for conceptual framework: Reperfusion phenomena.

CHAPTER 3

Methodology

This chapter includes information about the design of the study, the sample selected, materials and equipment used, operational definitions, and the data collection procedure.

Design

This was a descriptive study, using retrospective chart review to identify the frequency of four different reperfusion phenomena occurring after thrombolytic therapy and their occurrence in the different genders. The four different reperfusion phenomena assessed were the relief of chest pain, frequency and type of dysrhythmias, decreased blood pressure associated with the dysrhythmias, and resolution of ST segment elevation. The frequency of occurrence in the different genders was compared.

Sample

This study used a convenience sample selected from three community hospitals. The charts from all individuals receiving TPA, SK, or a combination of TPA and SK from December, 1991 to February, 1993 were reviewed. The following patients were excluded from the sample: those with a documented history of dysrhythmias prior to administration of thrombolytic therapy and those who were on antiarrhythmic medication prior to thrombolytic therapy.

The rights of the individual were protected at all times. The patient's name was not used as identification. Instead, the medical record number of the chart was used by the researcher, and was not disclosed in any published results or discussions. The data collected were used for the purpose of this study only and were reported in composite form.

Procedure

The researcher reviewed charts of all patients who have received intravenous thrombolytic therapy from December, 1991 to February, 1993. A sample size of 67 subjects was obtained. Exclusions were made as directed in the sample limitations. Information was collected as listed below in Materials and Equipment.

The tool used to collect data was modified from the Lepley-Frey study, (1991). This tool contained demographic information as well as the patients' prethrombolytic therapy status to include vital signs; level, duration, and history of presentation of chest pain; EKG with respect to ST-segment elevation; any dysrhythmias; or medications given.

Chart review was conducted to include the time of symptom onset to initiation of thrombolytic therapy, the time of initiation of thrombolytic therapy to the appearance of reperfusion phenomena, and through resolution of the ST-segment. Data collection of reperfusion phenomena

was limited to 6 hours after thrombolytic therapy. The level of chest pain, blood pressure, dysrhythmias, EKGs taken, and medications given were documented on the Data-Collection Tool (Appendix A). The doctors notes were assessed for a documented perceived reperfusion.

Materials and Equipment

Chart review was the data collection method. The following information was obtained:

1. patient medical record number
2. patient age
3. patient sex
4. date of admission
5. admission diagnosis
6. EKG rhythm and vital signs prior to thrombolytic therapy
7. time of initiation and type of thrombolytic therapy
8. level of chest pain prior and during thrombolytic therapy
9. time chest pain relief is documented.
10. the type and time of dysrhythmias during infusion
11. vital signs during infusion
12. EKGs during the infusion
13. medications during infusion
14. location of artery blockage

15. significant history

16. cardiac medications prior to admission

17. documented time of perceived reperfusion

18. time and amount of peak cardiac enzymes

Operational Definitions

1. Dysrhythmia--Any rhythm that deviates from normal sinus rhythm (rate 60-100 beats/min., P-R interval .12-.20 sec., QRS duration 0.06-0.10 sec.).

2. Sinus bradycardia (SB)--Heart rate less than 60 beats/min. with all other intervals normal.

3. Premature ventricular contractions (PVCs)--Beats arising early in the cycle without evidence of a P wave, a wide bizarre QRS with a duration of 0.12 sec. or greater. In this study, only the PVCs meeting the following criteria were included: five or more PVCs/min.; PVCs that fall on the T wave of the preceding beat; PVCs which occur in pairs or runs (i.e., ventricular tachycardia) or which are multiformed (arise from different ventricular foci). These are the most lethal form of PVCs.

4. Ventricular tachycardia (VT)--Three or more consecutive ventricular beats that occur in rapid succession (rate 140-200 beats/min.), with the R-R intervals remaining regular.

5. Ventricular fibrillation (VF)--Erratic baseline, no distinguishable PQRST wave forms can be seen. It is

associated with a loss of consciousness and palpable pulse.

6. Junctional rhythm (IVR)--Rate of 40-60 beats/min., regular R-R interval, QRS duration no greater than 0.12 sec. The P-wave is usually inverted and may occur during before or after the QRS. If the P-wave occurs before the QRS there is a short PR interval of less than 0.12 width.

7. Accelerated IVR (AIVR)--Rate of 60-90 beats/min., Regular R-R interval, with a QRS duration greater than 0.12.

8. AV blocks--to include: first degree block- where the PR is greater than .20. All other criteria are like NSR; second degree block type I- where there is a gradual lengthening of the PR interval until one of the QRSs are dropped; second degree block type II- the PR interval can be prolonged or normal but there is blocking or the dropping of a QRS. The PR intervals that precede a QRS are consistent in duration; third degree (complete heart block)- the P-wave and QRS have no relationship or consistency of placement. The P-waves consistently occur at their own rate and the QRS consistently occurs usually at a lesser rate of 40-60 if the QRS is less than 0.12 or at less than 40 if the QRS is wide, greater than .12.

9. Reperfusion dysrhythmia--any dysrhythmia that occurred at the time of reperfusion.

10. ST-segment resolution--The ST-segment is normally the flat isoelectric line between the QRS and T wave. During an AMI it becomes elevated (or possibly depressed if it is a subendocardial infarction) in the leads which reflect the infarcting area of the heart. Though it can be and often is much higher, at least one millimeter of elevation in the limb leads and two millimeters in the chest (V) leads is usually diagnostic of an AMI. At the time of reperfusion, oxygen and blood flow return to the area of the heart that was infarcting. This stops the process and salvages valuable tissue leading to the ST-segment returning to baseline. A noticeable difference was usually seen within minutes and often complete return of the ST-segment occurred within 100 minutes. For the purposes of this study ST-segment resolution was measured in millimeters as it occurs in part or as complete return toward the isoelectric baseline.

11. Relief of chest pain--Commonly during an AMI, the patient's chest pain varied with the medications given and was normally rated on a scale of 0 to 10 with 0 being "no chest pain" and 10 being "as bad as it could possibly be." At the time of reperfusion, it often for just a moment got worse and then suddenly the patient verbalized

total relief. For the purposes of this study chest pain was recorded on a scale of 0 to 10 with 0 being total relief as indicated by the documentation of the patients' remarks.

12. Time of perceived reperfusion--The first noticed reperfusion phenomenon by the nurse was frequently a dysrhythmia that set off the patients' alarm on the cardiac monitor. At that time the patient was normally assessed and treated as necessary to stabilize his condition. Often the patient reported feeling worse momentarily, then stated that the pain was gone and the short-lived dysrhythmia that occurred as a result of reperfusion was over. Vital signs, EKGs, and laboratory analysis of cardiac enzymes were obtained. The more reperfusion phenomena that occurred, the more likely that reperfusion had occurred. The time the first occurrence of any reperfusion phenomena was documented, as well as the doctor's assessment that reperfusion had occurred, was considered the time of perceived reperfusion for this study. Normally this was further supported by the cardiac enzyme levels and the follow up cardiac catheterization.

Data Analysis

Descriptive and inferential statistics were used to analyze the data including the chi square and the *t* test. In all analysis, $p \leq .05$ was considered statistically significant.

Assumptions and Limitations

The theoretical assumptions were that the reperfusion phenomena described in this study were a direct result of reperfusion and were the earliest response to reperfusion. It was assumed that the information in the chart was complete and accurate, and that all dysrhythmias that occurred were documented during the time frame of data collection. It was also assumed that the level of chest pain was accurately assessed and documented as well as all the dysrhythmias, blood pressures, and ST-segment changes on the EKGs. One limitation of this study was the inability to control for dysrhythmias that occur as a result of the ischemic process and not necessarily reperfusion. Another limitation was the difficulty in determining the variables other than dysrhythmias which may influence blood pressure. Careful assessment of the time of occurrence of the other reperfusion phenomena was used to help single out the reperfusion dysrhythmias and blood pressure changes.

CHAPTER 4

Results

This chapter includes the results of the various statistical procedures used to analyze the data. Presented are the demographic data, the type of thrombolytic, the analysis of reperfusion, and other findings as they relate to reperfusion phenomena and their occurrence by gender.

A convenience sample of 91 charts were reviewed from three community hospitals. Twenty-four charts of 6 women and 17 men were excluded because of arrhythmias or anti-arrhythmic therapy prior to receiving thrombolytic therapy. Also excluded, was one male who died shortly after SK was started. The final sample (N = 67) consisted of 29 women and 38 men that had received thrombolytic therapy between December, 1991 and February, 1993. Only subjects that received the intravenous route of TPA, SK, or a combination of SK and TPA were included.

Demographics

The men and women in this sample were very similar in the presentation of age, race, risk factors, and site of AMI. The mean age of women was 60 (SD 11) and of men was 57 (SD 11), with no significant difference by gender, $t(65) = 1.11$, $p = .270$. In the group of women, 25 (86.2%) were Caucasian, 2 (6.9%) were Black, 1 (3.4%) was Hispanic, and 1 (3.4%) was American Indian. In the men's

group, 33 (86.8 %) were Caucasian, 1 (2.6%) was Black, 1 (2.6%) was Hispanic, 2 (5.3%) were Asian, and 1 (2.6%) was American Indian.

Listed in Table 1 is the occurrence of risk factors by gender. These risk factors were not significantly different between men and women when analyzed individually (Table 1) or when grouped, $t(63) = .18$, $p = .857$.

The site of AMI was divided into anterior and inferior. In the group of women 8 (27.6%) had anterior AMIs and 21 (72.4%) had inferior AMIs. In the men's group 16 (42.1%) had anterior AMIs and 22 (57.9%) had inferior AMIs. A chi-square analysis, $X^2(1, N = 67) = 1.51$, $p = .219$, demonstrated that the distribution of presentation of AMI site between men and women was not statistically significantly different than would be expected by chance.

Overall, the mean amount of cardiac medications for women was .793 (SD .98) which was higher than the mean amount of cardiac medications for men of .263 (SD .55). This difference was statistically significant, $t(42) = 2.62$, $p = .012$.

Type of Thrombolytic

A chi-square analysis demonstrated that the type of thrombolytic given did not vary significantly by gender $X^2(2, N = 67) = .81$, $p = .667$. Of the women, 14 (48.3%) received SK, 10 (34.5%) received TPA, and 5 (17.2%)

received the SK and TPA combination. Of the men, 17 (44.7%) received SK, 11 (28.9%) received TPA, and 10 (26.3%) received the SK and TPA combination.

Table 1

Occurrence and Percentage of Risk Factors by Gender

	Women		Men		
Risk	n	%	n	%	p
Diabetes	8	27.6	4	10.5	.071
Hypertension	11	37.9	8	21.1	.128
Family History	7	24.1	17	44.7	.081
Smoking	7	24.1	14	36.8	.424
Hyperlipidemia	13	34.8	10	26.3	.114
Prior Angina	6	20.7	7	18.4	.816
Prior MI	4	13.8	10	26.3	.212
Obesity	2	6.9	3	7.9	.878

Assessment of Reperfusion

Mean Time Intervals

Five mean time intervals were examined:

1. from symptom onset to time of arrival,
2. arrival to start of thrombolytic infusion,
3. start of infusion to relief of pain,
4. the start of infusion to signs of reperfusion,
5. the start of infusion to ST-segment resolution.

The mean times in minutes for these intervals are listed in Table 2. The differences between men and women for each time interval were not significant (see Table 2). The mean time in minutes from the onset of symptoms to the start of thrombolytic therapy was calculated for women (M = 175, SD = 98) and men (M = 151, SD = 80) by adding the first and second intervals. The time to treatment for women was 24 minutes longer than for men but this was not statistically significant, $t(65) = 1.07$, $p = .289$. One woman, with pericarditis, continued to have chest pain which caused the number of women (n = 28) to drop in interval three. Three women failed to reperfuse, causing the number of women (n = 26) to drop in interval four. Only some subjects (n = 27), had continuous ST monitoring, causing the number of women (n = 12) and the number of men (n = 15) to drop in interval five.

Table 2

Mean Time Intervals in Minutes from Symptom Onset to ST Resolution

	Women		Men				
Interval	Mean	SD	Mean	SD	t	df	p
1. Onset to arrival[a]	106	90	96	72	.48	65	.635
2. Arrival to infusion[a]	69	34	55	31	1.74	65	.087
3. Infusion to pain relief[b]	122	120	116	118	0.19	64	.853
4. Infusion to reperfusion[c]	79	65	100	113	0.92	61	.359
5. Infusion to ST resolution[d]	109	65	98	83	0.37	25	.716

[a] n = 29 for women, n = 38 for men.

[b] n = 28 for women, n = 38 for men.

[c] n = 26 for women, n = 38 for men.

[d] n = 12 for women, n = 38 for men.

Reperfusion Dysrhythmias

Table 3 lists the mean frequencies of the type of dysrhythmias as they occurred by gender. One woman who developed pericarditis and three women who failed to reperfuse were not considered in the analysis of reperfusion dysrhythmias, decreasing the number of women (n = 25) in the final analysis. There was no significant difference ($p > .05$) between genders in the frequencies of any type of dysrhythmia seen (see Table 3). When all the rhythms were analyzed together the mean frequency for men was 3.08 (SD 2.42) which was higher than the mean frequency of rhythms for women of 2.4 (SD 2.27), but this was not significant, $t(61) = 1.12$, $p = .269$.

In a subset (n = 23) of subjects that had a drop in blood pressure, there were n = 8 women and n = 15 men. In this group, men had significantly more VT, $t(18) = 2.74$, $p = .013$. The mean frequency of occurrence of VT in the men of this group was .933 (SD 1.03) which was higher than the Table 3 mean frequency of VT in women of .125 (SD 0.35). For all other types of rhythms in this group there was no statistical difference ($p > .05$) in occurrence by gender.

Hemodynamic Effects

The means for systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean blood pressure (MBP) were calculated, for men and women, in time intervals from 30 minutes prior to 60 minutes after chest

Table 3

Mean Frequencies of Reperfusion Dysrhythmias

	Women[a]		Men[b]				
Rhythm	Mean	SD	Mean	SD	t	df	p
SB	0.36	0.81	0.47	0.69	0.60	61	.550
PVC	0.92	1.15	1.26	1.47	0.99	61	.328
VT	0.16	0.47	0.42	0.79	1.64	61	.107
VF	0.0	0.00	0.03	0.16	1.00	37	.324
IVR	0.0	0.00	0.03	0.16	1.00	37	.324
AIVR	0.28	0.61	0.37	0.85	0.45	61	.656
JR	0.16	0.62	0.21	0.62	0.31	61	.754
AV Blocks	0.2	0.82	0.08	0.36	0.70	30	.490

[a] $n = 29$. [b] $n = 38$.

pain relief. The difference in the mean SBP, mean DBP, and the mean MBP in the various time intervals did not vary significantly ($p > .05$) by gender in the group as a whole ($N = 67$).

In a subset of the subjects ($n = 23$) who had a drop in blood pressure at the time of reperfusion, there was a significant difference between genders in the time interval of 15 minutes prior to chest pain relief. The mean SBP for women was 122 (SD 20) and for men was 93 (SD 17). The mean DBP for women was 68 (SD 12) and for men

was 52 (SD 15). The mean MBP for women was 87 (SD 14) and for men was 66 (SD 14). Therefore, men had a significantly lower SBP, $t(16) = 3.26$, $p = .005$, than women, a significantly lower DBP, $t(16) = 2.51$, $p = .023$, and a significantly lower MBP, $t(16) = 3.05$, $p = .008$, at 15 minutes prior to chest pain relief. Due to missing data, the number of subjects ($n = 18$) in this group dropped, leaving fewer ($n = 7$) women and fewer ($n = 11$) men for analysis during this time interval.

The difference by gender in the means of SBP throughout the time intervals are plotted in Figure 2. The difference by gender in the means of DBP are plotted in Figure 3. The difference by gender in the means of MBP are plotted in Figure 4.

CPK and CKMB Results

Two of the subjects had no record of CPK or CKMB cardiac enzyme results. Therefore, the sample ($N = 65$) analyzed for differences in cardiac enzyme levels has 28 women and 37 men. The CPK and CKMB peaked in 12 hours in 25 (89.3%) of the women and 34 (91.9%) of the men. The peak of the CPK and CKMB enzymes took $\geq$ 12 hours for 3 (10.7%) of the women and 3 (8.1%) of the men. A chi-square analysis, $X^2(1, N = 65) = .129$, $p = .719$, of these cardiac enzymes, showed no significant difference in occurrence by gender.

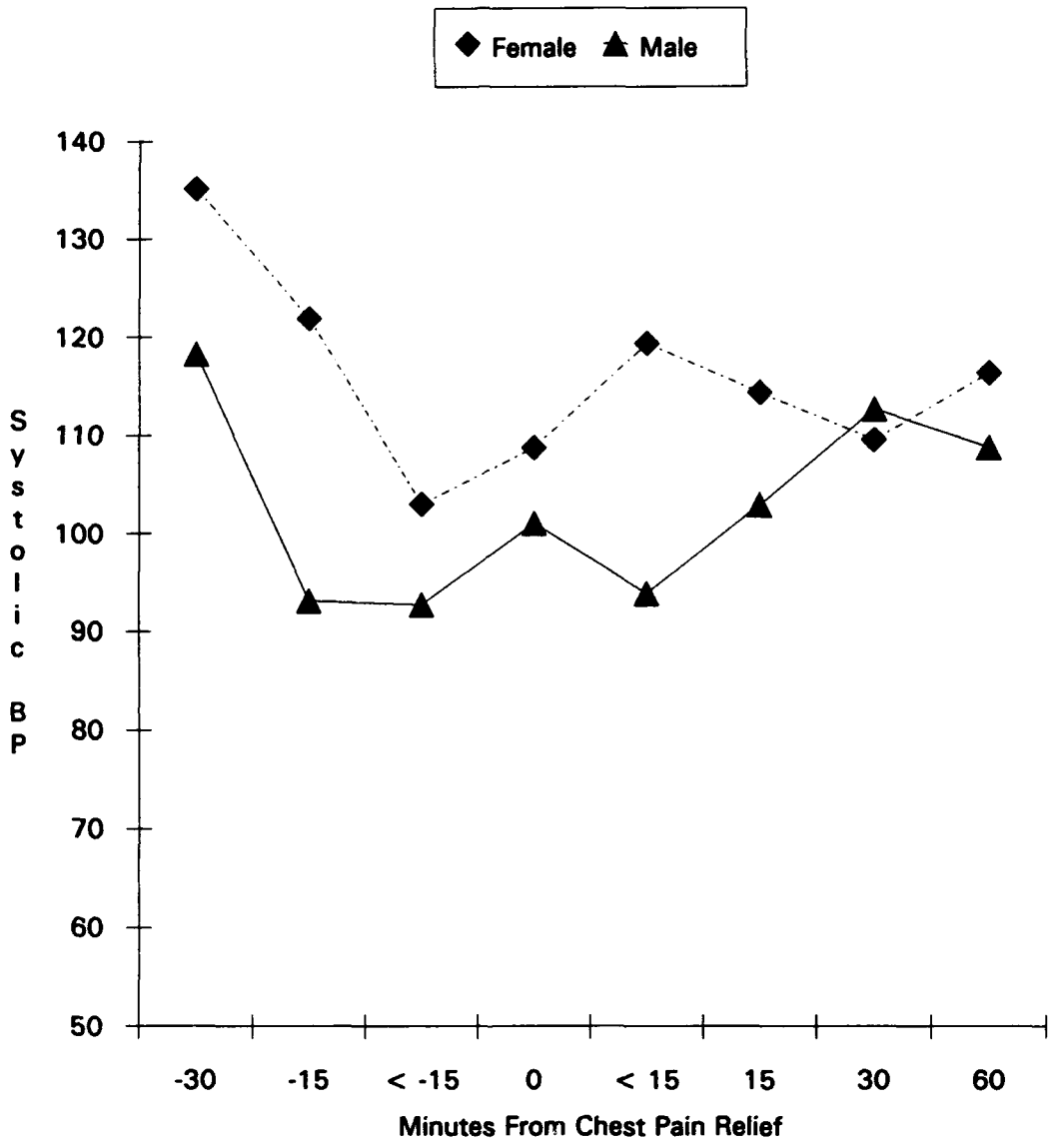

Figure 2. Systolic blood pressures from 30 minutes prior to 60 minutes after chest pain relief.

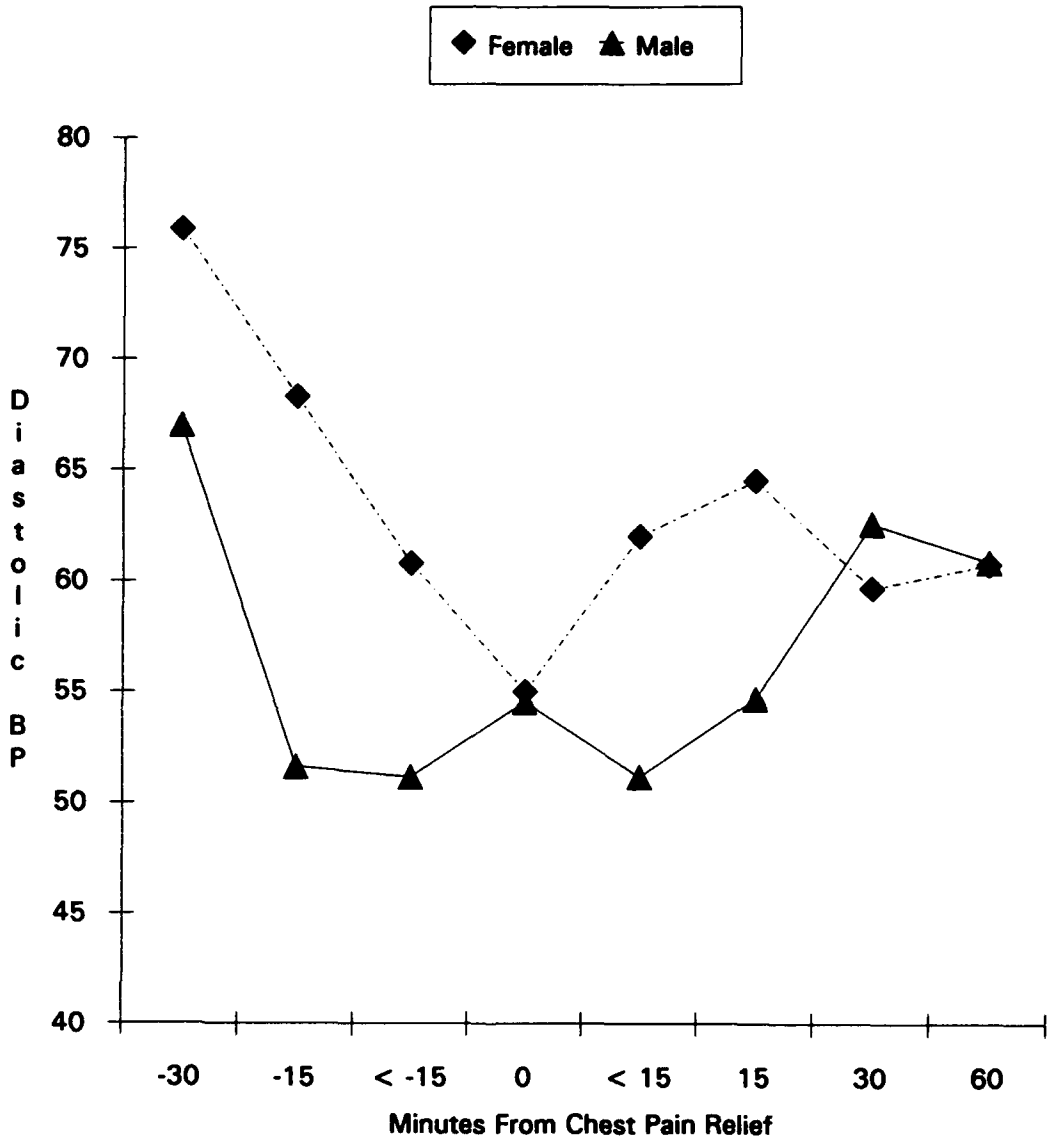

Figure 3. Diastolic blood pressures from 30 minutes prior to 60 minutes after chest pain relief.

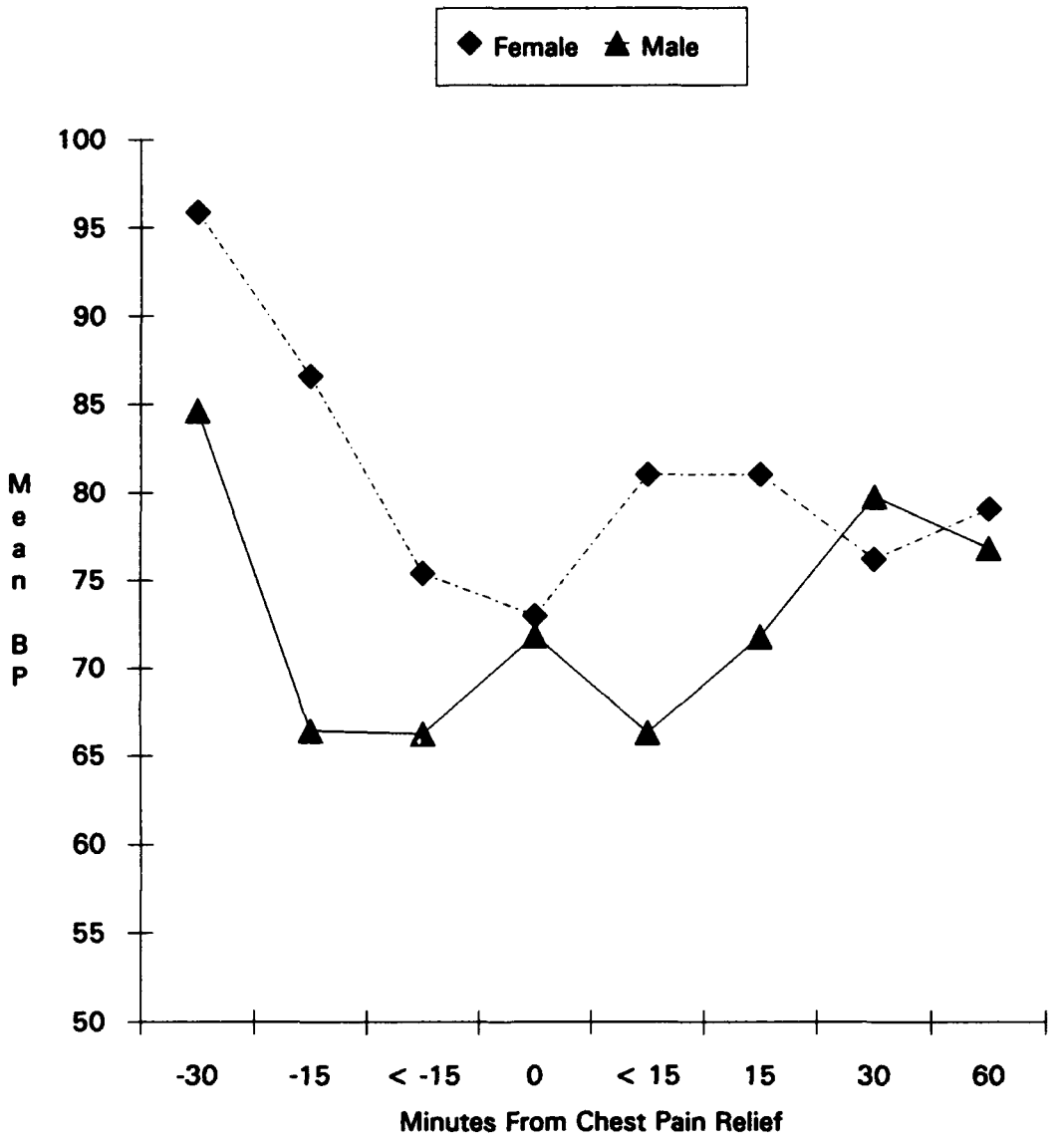

Figure 4. Mean blood pressures from 30 minutes prior to 60 minutes after chest pain relief.

More data were missing for the analysis of the mean peak levels of the CKMB analysis, leaving women with an *n* of 26 and men with an *n* of 36. The mean peak of CPK for women was 1294 (*SD* 1375), while the mean peak of CPK for men was 1779 (*SD* 1323), this difference was not statistically significant, $t(63) = 1.44$, $p = .156$ by gender. The mean peak of CKMB for women was 175 (*SD* 207) and for men was 176 (*SD* 147), which was also not significant, $t(32) = .20$, $p = .846$, by gender.

Occurrence of Reperfusion

Evidence of reperfusion occurred in 26 (89.7%) of the women and in 38 (100%) of the men. Out of 29 women, the attending physician recorded that there was no evidence of reperfusion in 3 (10.3%), nor was any sign of reperfusion seen in the chart review. A chi-square analysis was done to compare the occurrence of reperfusion by gender which demonstrated that significantly, $X^2(1, N = 67) = 4.12$, $p = .043$, fewer women had evidence of reperfusion after thrombolytic therapy.

Cardiac Catheterization Results

The total attempts to refer women for a cardiac catheterization was 23 (79%) out of 29. One woman refused the procedure. Three other women were referred for a cardiac catheterization outside of the hospital but the results were unavailable for analysis. Therefore, out of the original sample size (*N* = 67), 50 subjects had cardiac

catheterization results available. Of these subjects, 18 were women and 32 were men.

The infarct as it occurred by gender in the left anterior descending (LAD) coronary artery, the right coronary artery (RCA), the left circumflex coronary artery (LCX), and the obtuse marginal (OM) coronary artery are illustrated in Table 4. Not represented are the 11 (37.9%) of women and 6 (15.8%) of men whose results were unavailable. A Chi-square analysis, $X^2(4, N = 67) = 5.13$, $p = .274$, demonstrates there were no significant differences between men and women in the location of the infarct-related artery.

Table 4

Infarct-Related Artery Occurrence by Gender

	LAD		RCA		LCX		OM	
Gender	n	%	n	%	n	%	n	%
Women[a]	6	20.7	10	34.5	2	6.9	0	0.0
Men[b]	13	34.2	15	39.5	3	7.9	1	2.6

[a] $n = 29$. [b] $n = 38$.

The mean percentage of infarct artery occlusion for women was 90.17 compared to that of men which was 84.75. This difference was not statistically significant, $t(48) = .96$, $p = .341$.

Missing data were in the cardiac catheterization report itself; therefore, when analyzing the mean percent of left ventricular ejection fraction (LVEF) there were only 13 women and 21 men. The mean percent of LVEF for women was 42.69 (SD 11.66) and for men was 41.71 (SD 15.41). This difference was not statistically significant, $t(32) = .20$, $p = .846$.

Of the 18 women that had cardiac catheterization, 5 (28%) were referred for percutaneous transluminal coronary angioplasty (PTCA) and 2 (11%) were referred for coronary artery bypass graft (CABG) surgery. Of the 32 men that had cardiac catheterization, 12 (38%) were referred for PTCA and 5 (16%) were referred for CABG surgery.

Summary of Findings

In summary, women and men were very similar in presentation prior to thrombolytic therapy; however, women were on significantly ($p = .012$) more cardiac medications than men. The type of thrombolytics given to men and women was not significantly different. There was no significant difference between men and women in the time to treatment, to chest pain relief, to reperfusion, or to ST-segment resolution. In the group as a whole, there was

no significant difference between men and women in the frequency of occurrence of any type of dysrhythmia. In a subgroup of subjects with a drop in blood pressure during reperfusion, however, men had a statistically significant (p = .013) higher occurrence of VT than women. In this same subset of subjects, men also had a significantly lower mean SBP (p = .005), DBP (p = .023), and MBP (p = .008). There was no statistically significant difference between men and women in the mean amount, or mean time to peak CPK or CKMB cardiac enzymes. Significantly more men (p = .043) had signs of reperfusion than women. The cardiac catheterization results presented no statistically significant difference between men and women in the infarct related artery, percentage of coronary occlusion, or in the percentage of LVEF. Women, however, were referred less often for cardiac catheterization, PTCA, and CABG than men.

CHAPTER 5

Discussion

This chapter includes a discussion of how the findings of this study relate to the occurrence of reperfusion phenomena in the different genders. Findings from the demographics, type of thrombolytic given, assessment of reperfusion, and the cardiac catheterization results will be addressed. Other findings noted in the course of data collection will also be discussed. The nursing considerations, limitations of the study, and suggestions for further research will also be covered.

Demographics

It was important to consider any difference by gender that were present prior to thrombolytic therapy. In the listing of possible hypotheses explaining why women typically do not fair as well as men after thrombolytic therapy, Eysman and Douglas (1992) reported that it is possible that women do not do as well because they are typically older, have more diseases, and are on more medications than men. In this study, the men and women were very similar in their presentation of age, race, risk factors, and site of AMI. In review of the results of the risk factors (see Table 1), although no statistical significance was found, more women had diabetes, hypertension, and hyperlipidemia while men had a greater history of smoking and family history of CAD. It is

possible that a larger sample size would have resulted in significant findings on these variables.

When medications were analyzed individually there were no significant differences between men and women. It was noted, however, that women were on more nitroglycerine and several kinds of antihypertensive medications; therefore, cardiac medications were analyzed as a group. When the medications were analyzed as a group, women were found to be on significantly more cardiac medications. Other noncardiac medications, such as insulin, Theophylline, and hormones were not considered in this analysis; however, these medications might have played a significant role in the patient's health status on presentation to and eventual outcome following thrombolytic therapy.

Type of Thrombolytic

The type of thrombolytic therapy given did not differ significantly between men and women. This may be due to the Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries (GUSTO) trial (The Gusto Investigators, 1993) that was in progress during the time frame that these subjects had received thrombolytic therapy. It is interesting to note that of the entire sample 47% received SK, 31% received TPA, and 22% received the combination of SK and TPA. Now that the results of the GUSTO (1993) study have been reported, there is supporting evidence for the first time that TPA

has almost a 1% advantage over SK in reducing the mortality rate after an AMI. The type of thrombolytic chosen is usually the decision of the physician and SK may have frequently been chosen because its cost ($220.00) is much lower than that of TPA ($2200.00). Although TPA is estimated to save 9 out of 1000 lives over SK, the cost per each life saved is estimated by Conti (1993) to be more than $200,000 over the cost of using SK. While it is difficult to place a price on one's life, with today's focus on health care reform and cutting cost, further study of a cost effective approach to thrombolytic therapy is needed. Also needed, is further analysis of the type of thrombolytic therapy and proper dosage for women verses men. Although both genders were included, GUSTO (1993) did not report any differences between men and women in the occurrence of reperfusion, morbidity, or mortality rates.

Assessment of Reperfusion

Any difference in the occurrence of reperfusion phenomena between men and women was of primary concern in this study. Differences in the relief of chest pain and ST-segment resolution by gender are discussed as they occurred in the analysis of the mean time intervals from symptom onset to ST resolution. The discussion of reperfusion dysrhythmias, hemodynamic effects, CPK and CKMB, and occurrence of reperfusion follow.

Mean Time Intervals

Although all the mean time intervals demonstrated that there were no significant differences between men and women, women took longer from the time of symptom onset to the time of hospital arrival as well as from the time of arrival to the start of thrombolytic infusion. In this sample women only took approximately 10 minutes longer than men to arrive at the hospital. Women also took approximately 14 minutes longer than men from arrival to the hospital to the start of thrombolytic infusion. When these intervals are added together there is a delay of 24 minutes from the onset of symptoms to the initiation of thrombolytic therapy for women over men but this difference was not statistically significant. It must also be stated here that the time of onset of symptoms was considered by the physicians as beginning at the time chest pain became continuous. During chart review it appeared that women had more intermittent chest pain prior to the documented time of symptom onset. This then may indicate that women do take longer to arrive at the hospital. Another more recent study (Jenkins et al., 1994) with a larger sample size, found that women did take significantly ($p = .026$) longer to seek medical care as well as longer referral times for treatment than men. Even just minutes of delay to treatment are considered to have detrimental effects on the myocardial tissue

viability and response to reperfusion (Coombs et al., 1992; Reimer, Kower, Rasmusen, & Jennings, 1977).

The first research question was whether the relief of chest pain occurred differently in men than in women. To answer this, the mean time interval from start of thrombolytic therapy to the relief of chest pain was analyzed for differences in gender. There was no statistical difference found in the time to chest pain relief between men and women. Over all, the nursing documentation of the level of chest pain on a scale of 0-10 was very complete, therefore, this can be considered a relatively accurate assessment.

Sometimes other signs such as lessening of the ST-segment or reperfusion dysrhythmias would occur prior to the relief of chest pain. This finding is consistent with other findings (Krucoff et al., 1986; Lewis et al., 1988). Therefore, interval 4 in Table 2 reflects the mean time to the first sign of reperfusion, whether it be relief of chest pain, lessening of the ST-segment, or reperfusion dysrhythmias. It is interesting to note that when interval 4 is subtracted from interval 3, women had signs of up to a mean time of 43 minutes prior to the mean time of the relief of chest pain. The mean time to the first signs of reperfusion, however, occurred only 17 minutes prior to the relief of chest pain. Often the presentation of reperfusion dysrhythmias and lessening of the ST-

segment occurred frequently just before and during the lessening of chest pain before relief was rated as complete by women and men. This is consistent with other angiographic studies (Krucoff et al., 1986; Lewis et al., 1988) which noted that the occurrence of these phenomena together are reliable clinical markers of reperfusion.

The fourth research question of this study was posed to determine whether or not there was a difference in occurrence of resolution of the ST-segment between men and women. Time interval number 5 demonstrated the mean time from start of thrombolytic therapy to ST resolution. Though women took slightly longer for the ST to return to the baseline than men, this difference was not statistically significant. Because the number of subjects dropped in interval 5, this interval cannot be compared to interval 3 or 4 for these intervals contain several more subjects who took longer to reperfuse. During the chart review process of the subjects that had continuous ST-segment monitoring, 50% to complete ST-segment resolution was evident at the time of or within 20 to 30 minutes following chest pain relief. Other research (Gressin et al., 1993), using Holter monitoring, has found similar rates in resolution of the ST-segment to be an excellent predictor of reperfusion. The 12 lead EKGs were not continuous and were taken at various times after signs of reperfusion; therefore, these data were not useful for

determining the time of ST resolution. Instead, the EKGs were more helpful in confirming that reperfusion had taken place.

Reperfusion Dysrhythmias

This section addresses research question number two concerning whether reperfusion dysrhythmias occur differently by gender. In the group as a whole, the most frequent dysrhythmias were, in order, PVCs, SB, AIVR, VT, JR, and AV blocks. The high occurrence of PVCs is consistent with other findings but PVCs may also be a result of ischemia and not reperfusion (Gressin et al., 1993). The high frequency of SB is most likely related to the frequent administration of intravenous atenolol or Lopressor. It may also be because this sample had more inferior AMIs which were noted by Irwin (1988) to frequently result in SB reperfusion dysrhythmias. Other studies (Gressin et al., 1991; Krucoff et al., 1986; Lewis et al., 1988) have seen AIVR as the most frequent reperfusion dysrhythmia. During the process of chart review, it was noted that several subjects had AIVR late (> 6 hours) after thrombolytic therapy was started which was beyond the time frame of data collection for this study. According to Gressin et al. (1993) early frequent and repetitive AIVR can have a 95% positive predictive accuracy for patency, however the lack of AIVR is not very predictive of failure to reperfuse. Gressin et al. (1993)

also suggested that cardiac monitoring should continue past 12 hours from the start of thrombolytics; otherwise, late reperfusion dysrhythmias might be missed. VT and JRs, especially AJR, have also been seen as frequent reperfusion dysrhythmias (Gressin et al., 1991; Krucoff et al., 1986; Lewis et al., 1988). The occurrence of AV blocks in this study may also be related to the beta-blocker therapy of atenolol and Lopressor or the high incidence of inferior AMIs.

When comparing men and women there was no significant difference in the frequency of any of the type of dysrhythmias. When the type of dysrhythmias were combined, men on the whole had more dysrhythmias than women, but this was not statistically significant. In reviewing the data, it was noted that a subset of 23 (34%) subjects from the sample had a drop in blood pressure during the occurrence of reperfusion dysrhythmias.

In this subset it was found that men had a significantly greater occurrence of VT than women. The men in this subset also appeared to have more ventricular rhythms in general, however, when the ventricular rhythms were grouped there was no significant difference between men and women.

Hemodynamic Effects

Another question of interest was whether or not there were differences in the hemodynamic effects of reperfusion

dysrhythmias by gender. To analyze the hemodynamic effects the means for the SBP, DBP, and MBP were compared between men and women in time intervals from 30 minutes prior to the relief of chest pain to one hour after relief of chest pain had occurred. This took into consideration most of the reperfusion dysrhythmias in the sample. There was no statistically significant difference in any blood pressure variable when men and women were compared from the group as a whole. It was noted, however, that only 23 subjects had a drop in blood pressure with the reperfusion dysrhythmias. Therefore, this subset of 23 subjects was analyzed separately. In this sample, men tended to have lower blood pressures than women but they only became significantly lower than women 15 minutes prior to the relief of chest pain. The time frame that represented the lowest blood pressures for both men and women was just prior (< 15 minutes) to the relief of chest pain (See Figures 2, 3, and 4). One reason men had lower blood pressure than women may be due to the higher incidence of hypertension in women than men on presentation prior to thrombolytics. Since men had more ventricular rhythms than women in this sample, it is consistent with other findings (Lepley-Frey, 1991) that men should have greater hemodynamic consequences. This does not, however, explain why women have higher mortality rates than men after thrombolytics. Instead, if men have more ventricular

rhythms and greater hemodynamic consequences, it might be expected that men would not do as well as women. An alternate explanation is that the more frequent presentation of these ventricular rhythms and hemodynamic consequences in men may indicate a more frequent occurrence of reperfusion in men than in women. This possibility will be further explored in the discussion of occurrence of reperfusion.

CPK and CKMB

Previous studies (Lewis et al., 1988) have reported an abrupt rise in CPK and CKMB with much higher and earlier (≤ 12 hours) peaks in the presence of reperfusion than that seen in the normal evolution of an AMI. These results are consistent with the findings of this study. In comparing the mean peak of CPK and CKMB between men and women, the men appeared to peak higher than women but this difference was not statistically significant. More of the men (91.9%) peaked early (≤ 12 hours) than the women (89.3%), but this difference was also not statistically significant.

Occurrence of Reperfusion

It is interesting to note that significantly more men had signs of reperfusion than women. Three of the women had no evidence of reperfusion, and were considered by the attending physician as unsuccessful in reperfusing. If significantly fewer women reperfuse this could explain in

part why women have not done as well in previous trials (ASSET, 1989; European Working Party, 1971; GISSI-1, 1986, 1987; ISIS-2, 1988; Kennedy et al., 1988). This finding, however, requires further study because even though 100% of the men in this sample were considered to have signs of reperfusion, not all of them demonstrated a benefit from thrombolysis. This could be related to later reocclusion or reperfusion injury (Hearse & Bolli, 1991) or it may be that some of the dysrhythmias were really ischemic in origin and not reperfusion in origin (Lepley-Frey, 1991) which would explain the higher (100%) rate of reperfusion phenomena in men.

Cardiac Catheterization Results

No significant difference between men and women was found in the occurrence of the site of the infarct-related artery, the degree of stenosis, or the LVEF. This finding may have been affected by the amount of missing data, especially in relation to the LVEF in this study. Occasionally, the cardiac catheterization report would state that the left ventricular function was preserved but no LVEF percentage was given. The cardiac catheterizations were also done frequently 48 to 72 hours after thrombolytic therapy was given. Reocclusion and reperfusion injury can often occur in this time frame (Gressin et al., 1993). Therefore a greater percentage of

coronary artery occlusion and a lower percentage of LVEF may be evident in this study.

Of particular interest is the finding that fewer women than men were referred to have a cardiac catheterization. It was also noted that fewer women than men were referred for PTCA and CABG procedures. The reason for the lower referral rate cannot be analyzed adequately by this study because the only outcome criteria assessed was the cardiac catheterization results which were often incomplete. Many of the subjects were noted to develop congestive heart failure after reperfusion but these data were not collected or compared between genders. Although the findings of this study suggest a less aggressive approach in the referral of women, further analysis would be required to assess whether the amount of referrals was appropriate or whether a less aggressive approach was used with women than with men.

Other Findings

During the data collection, the administration of other medications were followed to assess their effects on arrhythmias and blood pressure. Lidocaine was given prophylactically at the start of thrombolytic therapy to 8 (28%) of 29 women and 6 (16%) of 38 men. Of those who received the prophylactic Lidocaine 6 (75%) of the women, 5 (83%) of the men, and an overall 11 (78%) of the subjects had reperfusion arrhythmias anyway. Beta-

blockers, such as atenonlol, administered to 31 (46%) of the subjects, 13 of whom were women and 18 of whom were men. A drop in blood pressure and/or SB occurred in 21 (68%) of these subjects. Therefore, in attempting to focus only on the hemodynamic effects related to reperfusion arrhythmias, the only blood pressures analyzed were those that centered around the time frame that reperfusion phenomena occurred simultaneously.

Commonly, in an attempt to relieve chest pain, sublingual nitroglycerine, intravenous (IV) morphine sulphate and Tridil drips were given. Tridil was administered to 60 (89.6%) of the subjects, 25 of whom were women and 35 of whom were men. The Tridil drip was most often started at 5 to 10 mcg/min and then increased by 5 to 10 mcg/min every 5 to 10 minutes, as is recommended procedure (Gunnar et al., 1990). Titration end points for Tridil are the control of clinical symptoms or a decrease in mean arterial pressure of 10% in normotensive patients or 30% in hypertensive patients (but never a SBP < 90 mm Hg), an increase of heart rate greater than 10 beats/min (but not > 110 beats/min), or a decrease in pulmonary artery end-diastolic pressure of 10% to 30% (Gunnar et al., 1990).

It was noted that once the Tridil was started the use of morphine declined dramatically. In 29 (48%) of these subjects, the Tridil was titrated up to 70 mcg. or more,

without the additional use of morphine for over an hour, even though the patient continued to complain of chest pain rated up to 7 or 8 out of 10. The psychological and physiological effects of having chest pain can cause additional stress on the heart. It is the nurses' role as the patient's advocate to request pain medication if there is not already a standing order. Further, assuring the patients comfort is truly the nurses responsibility. It is possible that many staff nurses are unaware that giving an analgesic, such as IV morphine, while a patient is on a Tridil drip is not only acceptable but is preferred if the patient can tolerate it and continues to complain of chest pain (Gunnar et al., 1990).

Nursing Considerations

The findings of this study can help the critical care nurse in giving care to patients receiving thrombolytic therapy. Functions of the critical care nurse includes the monitoring of patients receiving thrombolytic therapy for signs of reperfusion, assisting in relieving the patient's chest pain, and treating the reperfusion dysrhythmias and hemodynamic consequences. This study provides additional knowledge of how reperfusion phenomena occur in both men and women. The critical care nurse should be aware that women have been found to have higher mortality rates after an AMI than men (Jenkins et al., 1994) and less reduction of mortality rates with

thrombolytic therapy than men (Eysman & Douglas, 1991). In this study, men had more VT and a greater hemodynamic compromise than women; however, these phenomena usually lasted only a few minutes and were signs that reperfusion occurred. Additionally, women were found to have evidence of reperfusion less often than men. Unfortunately, the lack of reperfusion means the irreversible loss of myocardial tissue. Knowing the gender differences in the occurrence of reperfusion phenomena gives insight to differences in the initial response to reperfusion and myocardial recovery and may assist the nurse in anticipating potential problems associated with thrombolytic therapy as they occur in men and women.

Another finding in this study was related to the management of chest pain. It should be stressed that every attempt should be made to relieve the patient's pain especially since the relief of pain is so closely related to reperfusion. The management of chest pain should include the administration of morphine in conjunction with Tridil drips as long as it is tolerated well by the patient.

Finally, critical care nurses should be aware that most likely, it is not one but many reasons suggested by previously mentioned authors (Eysman & Douglas, 1992; Legato & Colman, 1991), that explain why women have higher mortality rates than men after thrombolytic therapy.

Another recent study (Jenkins et al., 1994) adds further support to these hypotheses, that in comparison with men, women tend to be older, have more prevailing disease, seek medical care later, are referred for treatment later, and have more complications such as the occurrence of shock after an AMI. Whether the pathogenesis of infarction or recovery from infarction might be different in men and women requires further study.

Some of the data from this study suggests that there may be a less aggressive approach to treating women with CAD, and that the added delay in the time women arrive at the hospital and thrombolytics are initiated add up to precious minutes. Having standard protocols or algorhythms that assist in recognizing the criteria to give thrombolytics or the need to refer for mechanical methods of reperfusion may assist in providing appropriate treatment in a timely manner. Further, critical care nurses should encourage the inclusion of women and examination of gender differences in the large thrombolytic trials.

Limitations

A major limitation of this study is the small sample size. Part of this is due to the exclusion of the potential subjects who experienced dysrhythmias or who were on antiarrhythmic medications prior to thrombolytic infusion. The strict criteria were needed to better

isolate reperfusion dysrhythmias; however, a larger sample size may be needed to examine differences between men and women. Much of the data analyzed in this study resulted in a large standard deviation, which may be due to the small sample size and a few outliers. An alternate explanation is that the large standard deviation might suggest a heterogeneous sample. In either case, the large standard deviations limit the inferential power of the results of this study.

Another limitation is that chart review was the method of data collection. Chart review is not a favored method of data collection, since the information can be inaccurate or absent. There were times when the desired data, such as some of the cardiac catheterization records, were unavailable. Also, although most of the charts provided blood pressure monitoring every 15 minutes during thrombolytic infusion, this frequency of recording blood pressures was not the case after the infusion was complete. Therefore, there were many missing blood pressures, because reperfusion often occurs after the thrombolytic has infused.

Another limitation is that continuous ST-segment monitoring was not available in all the subjects. EKGs were not continuous and were taken after the signs of reperfusion had occurred; therefore, they were only helpful for confirmation that reperfusion had occurred.

Thus the number of subjects that could be studied for ST resolution was also limited. A better method for monitoring the ST-segment and dysrhythmias would be Holter monitoring.

Suggestions for Further Study

The need for further analysis of differences between men and women and their responses to thrombolytic therapy at the time of reperfusion and throughout the period of myocardial recovery is essential. This type of research may explain in part the differences in outcome by gender, but more importantly it may be helpful in identifying appropriate intervention strategies for men and women. Additionally, a larger sample would likely yield results that are generalizable to other populations. The use of Holter monitoring along with the continuous arterial monitoring of blood pressure to assess reperfusion dysrhythmias, ST-segment resolution, and hemodynamic consequences would provide a more accurate analysis of the differences in the occurrence of reperfusion phenomena by gender. Finally, it is important to continue to explore other areas that may affect the different outcomes between men and women, such as exploring the delays to treatment and methods to decrease them.

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APPENDIX A

Data-Collection Tool

DATA COLLECTION TOOL

Subject #:_____ Date/time of Adm:_____
Adm Diag:_____
Time of infusion:_____ Date of infusion:_____
Age_____ Sex_____
Cardiac medications prior to Adm:_____
_____
Symptom onset_____chest pain relief_____
Location of blockage:_____
Time of reperfusion_____
Time/Amt of Peak CPK, CK-MB_____
Type of agent SK or TPA (circle one)

Significant History:_____

Subject #:_____

Time	MAP	Change MAP	Level of Chest pain	Rhythm
0 (pre-infus)				
1 (start infus)				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

Subject #:_____

Time	ST-segment change	HR	Meds	Comments
0 (pre-infus)				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				

BIOGRAPHICAL SKETCH

Colleen R. Grinter has worked in critical care since 1984. She received her Bachelor of Science in Nursing degree from Kansas University in 1982. She joined the Air Force Nurse Corps in 1983. Her career as a military nurse has led her from Homestead AFB, Florida to Elmendorf AFB, Alaska, where she was selected for Air Force sponsorship of an education toward a Master in Science degree at Arizona State University. She has recently been selected for promotion to the rank of Major in the Air Force. She and her husband, Truman, have two children, Nanette and Travis. Following graduation, Colleen and her family will soon be residing at Sheppard AFB, Texas where she has accepted an assignment as the nurse manager of the critical care unit of the 82nd Medical Group.